

(19)



(11)

**EP 3 620 020 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**31.03.2021 Bulletin 2021/13**

(51) Int Cl.:  
**H04W 72/12<sup>(2009.01)</sup> H04W 74/08<sup>(2009.01)</sup>**

(21) Application number: **18726896.6**

(86) International application number:  
**PCT/US2018/031420**

(22) Date of filing: **07.05.2018**

(87) International publication number:  
**WO 2018/204922 (08.11.2018 Gazette 2018/45)**

**(54) TRANSMITTING A SCHEDULING REQUEST PRIOR TO COMPLETING A RANDOM ACCESS PROCEDURE FOR ANOTHER RADIO BEARER**

ÜBERTRAGUNG EINES SCHEDULING REQUESTS VOR DEM ABSCHLUSS EINES RANDOM ACCESS-VERFAHRENS FÜR EINEN WEITEREN FUNKTRÄGER

TRANSMISSION D'UNE REQUÊTE DE PLANIFICATION AVANT L'ACHÈVEMENT D'UNE PROCÉDURE D'ACCÈS ALÉATOIRE POUR UNE AUTRE PORTEUSE RADIO

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **05.05.2017 US 201762501902 P**

(43) Date of publication of application:  
**11.03.2020 Bulletin 2020/11**

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**Description**

## FIELD

**[0001]** The subject matter disclosed herein relates to electronic communications and more particularly relates to handling multiple UL access procedures.

## BACKGROUND

**[0002]** The following abbreviations and acronyms are herewith defined, at least some of which are referred to within the following description.

**[0003]** Third Generation Partnership Project ("3GPP"), Access and Mobility Management Function ("AMF"), Access Point Name ("APN"), Access Stratum ("AS"), Back-off Indicator ("BI"), Bandwidth Part ("BWP"), Carrier Aggregation ("CA"), Clear Channel Assessment ("CCA"), Control Channel Element ("CCE"), Channel State Information ("CSI"), Common Search Space ("CSS"), Data Network Name ("DNN"), Data Radio Bearer ("DRB"), Downlink Control Information ("DCI"), Downlink ("DL"), Enhanced Clear Channel Assessment ("eCCA"), Enhanced Mobile Broadband ("eMBB"), Evolved Node-B ("eNB"), Evolved Packet Core ("EPC"), Evolved UMTS Terrestrial Radio Access Network ("E-UTRAN"), European Telecommunications Standards Institute ("ETSI"), Frame Based Equipment ("FBE"), Frequency Division Duplex ("FDD"), Frequency Division Multiple Access ("FDMA"), Globally Unique Temporary UE Identity ("GUTI"), Hybrid Automatic Repeat Request ("HARQ"), Home Subscriber Server ("HSS"), Internet-of-Things ("IoT"), Key Performance Indicators ("KPI"), Licensed Assisted Access ("LAA"), Load Based Equipment ("LBE"), Listen-Before-Talk ("LBT"), Long Term Evolution ("LTE"), LTE Advanced ("LTE-A"), Medium Access Control ("MAC"), Multiple Access ("MA"), Modulation Coding Scheme ("MCS"), Machine Type Communication ("MTC"), Massive MTC ("mMTC"), Mobility Management ("MM"), Mobility Management Entity ("MME"), Multiple Input Multiple Output ("MIMO"), Multipath TCP ("MPTCP"), Multi User Shared Access ("MUSA"), Non-Access Stratum ("NAS"), Narrowband ("NB"), Network Function ("NF"), Next Generation (e.g., 5G) Node-B ("gNB"), Next Generation Radio Access Network ("NG-RAN"), New Radio ("NR"), Policy Control & Charging ("PCC"), Policy Control Function ("PCF"), Policy Control and Charging Rules Function ("PCRF"), Packet Data Convergence Protocol ("PCDP"), Packet Data Network ("PDN"), Packet Data Unit ("PDU"), PDN Gateway ("PGW"), Quality of Service ("QoS"), Quadrature Phase Shift Keying ("QPSK"), Radio Access Network ("RAN"), Radio Access Technology ("RAT"), Radio Resource Control ("RRC"), Receive ("RX"), Switching/Splitting Function ("SSF"), Scheduling Request ("SR"), Serving Gateway ("SGW"), Session Management Function ("SMF"), System Information ("SI"), System Information Block ("SIB"), Transport Block ("TB"), Transport Block Size ("TBS"), Time-Division Du-

plex ("TDD"), Time Division Multiplex ("TDM"), Transmission and Reception Point ("TRP"), Transmit ("TX"), Uplink Control Information ("UCI"), Unified Data Management ("UDM"), User Entity/Equipment (Mobile Terminal) ("UE"), Uplink ("UL"), User Plane ("UP"), Universal Mobile Telecommunications System ("UMTS"), Ultra-reliability and Low-latency Communications ("URLLC"), and Worldwide Interoperability for Microwave Access ("WiMAX").

**[0004]** Some wireless communication systems, only one Random Access procedure can be ongoing at any point in time in a MAC entity. If the MAC entity receives a request for a new Random-Access procedure while another is already ongoing in the MAC entity, it is up to the UE implementation whether to continue with the ongoing procedure or start with the new procedure.

**[0005]** R2-1702869 is a 3GPP discussion document titled "Random Access Procedure in NR" and submitted by Interdigital Communications at the RAN WG2 meeting in Spokane, Washington, USA on 3 April 2017, which discloses that a UE should be able to perform multiple concurrent RACH procedures, one per access requirement. R2-1702599 is a 3GPP discussion document titled "Considerations on RACH procedure" and submitted by Huawei et al at the RAN WG2 meeting in Spokane, Washington, USA on 3 April 2017, which proposes to configure different priorities to RACH procedures triggered by different services.

## BRIEF SUMMARY

**[0006]** The invention is defined by the appended claims.

**[0007]** In a first aspect, the invention provides a method for a user equipment, the method comprising: initiating a first random-access procedure for a first radio bearer, wherein the first radio bearer is associated with a first logical channel and is not configured with any physical uplink control channel resource for scheduling request messaging; receiving a scheduling request trigger for a second radio bearer while the first random-access procedure remains pending, the second radio bearer being associated with a second logical channel different than the first logical channel, wherein the second radio bearer is configured with physical uplink control channel resources for scheduling request messaging; determining whether simultaneous scheduling request transmission is permitted for the second bearer in response to the first random-access procedure being pending; and transmitting a first scheduling request message for the second radio bearer to a mobile communication network using physical uplink control channel resources configured for scheduling request messaging in response to simultaneous scheduling request transmission being permitted for the second bearer.

**[0008]** In a second aspect, the invention provides an apparatus comprising: a transceiver adapted to communicate with a mobile communication network using a plu-

rality of radio bearers; and a processor adapted to: initiate a first random-access procedure for a first radio bearer, wherein the first radio bearer is associated with a first logical channel and is not configured with any physical uplink control channel resource for scheduling request messaging; receive a scheduling request trigger for a second radio bearer while the first random-access procedure remains pending, the second radio bearer being associated with a second logical channel different than the first logical channel, wherein the second radio bearer is configured with physical uplink control channel resources for scheduling request messaging; determine whether simultaneous scheduling request transmission is permitted for the second bearer in response to the first random-access procedure being pending; and transmit a first scheduling request message for the second radio bearer using physical uplink control channel resources configured for scheduling request messaging in response to simultaneous scheduling request transmission being permitted for the second bearer.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** A more particular description of the invention as described above will be rendered by reference to the accompanying drawings, in which:

Figure 1 is a schematic block diagram illustrating a wireless communication system for handling multiple UL access procedures;

Figure 2 is a schematic block diagram illustrating a network procedure for handling multiple UL access procedures;

Figure 3 is a schematic block diagram illustrating a user equipment apparatus for handling multiple UL access procedures;

Figure 4 is a schematic block diagram illustrating a network equipment apparatus for handling multiple UL access procedures;

Figure 5 is a diagram illustrating enhanced backoff indicators for handling multiple UL access procedures;

Figure 6 is a flowchart diagram illustrating a method for handling multiple UL access procedures;

Figure 7 is a flowchart diagram illustrating a second method for handling multiple UL access procedures; and

Figure 8 is a flowchart diagram illustrating a third method for handling multiple UL access procedures.

#### DETAILED DESCRIPTION

**[0010]** As will be appreciated by one skilled in the art, aspects of the disclosure may be implemented as a system, apparatus, method, or program product. Accordingly, implementations may take the form of an entirely hardware implementation, an entirely software implementation (including firmware, resident software, micro-code,

etc.) or an implementation combining software and hardware aspects.

**[0011]** For example, the disclosure may be implemented as a hardware circuit comprising custom very-large-scale integration ("VLSI") circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. The disclosure may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices, or the like. As another example, the implementation may include one or more physical or logical blocks of executable code which may, for instance, be organized as an object, procedure, or function.

**[0012]** Furthermore, implementations may take the form of a program product embodied in one or more computer readable storage devices storing machine readable code, computer readable code, and/or program code, referred to hereafter as code. The storage devices may be tangible, non-transitory, and/or non-transmission. The storage devices may not embody signals. In a certain implementations, the storage devices only employ signals for accessing code.

**[0013]** Any combination of one or more computer readable medium may be utilized. The computer readable medium may be a computer readable storage medium. The computer readable storage medium may be a storage device storing the code. The storage device may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, holographic, micromechanical, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing.

**[0014]** More specific examples (a non-exhaustive list) of the storage device would include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random-access memory ("RAM"), a read-only memory ("ROM"), an erasable programmable read-only memory ("EPROM" or Flash memory), a portable compact disc read-only memory ("CD-ROM"), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

**[0015]** In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of the disclosure. One skilled in the relevant art will recognize, however, that implementations may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of an imple-

mentation.

**[0016]** Aspects of the disclosure are described below with reference to schematic flowchart diagrams and/or schematic block diagrams of methods, apparatuses, systems, and program products. It will be understood that each block of the schematic flowchart diagrams and/or schematic block diagrams, and combinations of blocks in the schematic flowchart diagrams and/or schematic block diagrams, can be implemented by code. This code may be provided to a processor of a general-purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the schematic flowchart diagrams and/or schematic block diagrams.

**[0017]** The code may also be stored in a storage device that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the storage device produce an article of manufacture including instructions which implement the function/act specified in the schematic flowchart diagrams and/or schematic block diagrams.

**[0018]** The code may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus, or other devices to produce a computer implemented process such that the code which execute on the computer or other programmable apparatus provide processes for implementing the functions/acts specified in the schematic flowchart diagrams and/or schematic block diagram.

**[0019]** The schematic flowchart diagrams and/or schematic block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of apparatuses, systems, methods, and program products. In this regard, each block in the schematic flowchart diagrams and/or schematic block diagrams may represent a module, segment, or portion of code, which includes one or more executable instructions of the code for implementing the specified logical function(s).

**[0020]** It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the Figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more blocks, or portions thereof, of the illustrated Figures.

**[0021]** The description of elements in each figure may refer to elements of preceding figures. Like numbers refer to like elements in all figures, including alternate

examples of like elements.

**[0022]** In LTE, only one Random-Access procedure can be ongoing at any point in time in a MAC entity. If the MAC entity receives a request for a new Random-Access procedure while another is already ongoing in the MAC entity, it is up to the UE implementation whether to continue with the ongoing procedure or start with the new procedure. In NR, a possible new reason to initiate a RACH procedure could be to send the SI-request message (Msg1 or Msg3 based method). The UE implementations aborting a corresponding RACH procedure for sending SI-request message would run the risk of delaying among others a public safety, vehicular and other critical services. For example, "aborting" the RACH procedure in Msg1 may mean that the UE does not even send the *reserved* preamble (for requesting a corresponding SIB), but rather waits for the other RACH procedure to complete - depending on the radio condition this may be a relatively long wait. However, "aborting" the RACH procedure in Msg3 may not be straightforward if the Msg3 grant size is different for SI-request and other purposes (e.g., UL grant).

**[0023]** To minimize delay, the UE may continue multiple RACH procedures in parallel when said RACH procedures are considered prioritized. One example is initiating multiple RACH procedures, each for a different SI request. However, if both RACH procedures are not considered prioritized, then the UE may cancel/abort the lesser priority procedure (e.g., non-SI request). In certain examples, continuing multiple RACH procedures in parallel includes transmitting multiple transmissions at the same time instant/ slot/ subframe.

**[0024]** In some examples, the multiple pending RACH procedures may have different priorities. Assume here, that a second RACH procedure is triggered while a first RACH procedure is already pending. Here, the UE may determine whether the pending RACH procedures request system information (SI-requests having higher priority than other RACH procedures) and determine whether the required SIB is considered "important" or "critical". Examples of important/critical SIBs include, but are not limited to, SIBs like Commercial Mobile Alert System ("CMAS"), Wireless Emergency Alerts ("WEA"), Earthquake and Tsunami Warning System ("ETWS"), vehicular, public safety, or any other critical communication.

**[0025]** If the first RACH procedure was started already and did not require an important/critical SIB, then the UE may cancel/abort the first RACH procedure and initiate a second RACH procedure for requesting SI, especially if the required SIBs are one of the important/ critical SIBs. Note that if for the first RACH procedure the UE already transmitted Msg1 for requesting SIB(s), then the UE shall not abort the first RACH procedure. Rather, the UE may send Msg1 for the second RACH procedure at the next RACH opportunity, without waiting to complete the first RACH procedure.

**[0026]** In some examples, the multiple pending RACH procedures may have the same priority. Assume again

that the second RACH procedure is triggered while the first RACH procedure is already pending. Here, multiple RACH procedures may be initiated for requesting SIBs where each (group of) SIB is linked to a corresponding Preamble.

**[0027]** If more than one SIBs are required and belong to different corresponding Preamble, then the UE may initiate a simultaneous Preamble transmission. However, in certain examples the transmit power required for all such transmission is not available/allowed in the UE. Therefore, the UE may initiate Preamble transmission sequentially (e.g. one by one). In this enhancement, the UE initiates transmission of a subsequent Preamble in the immediate next RACH opportunity, e.g., without having to wait for to receive the response (Msg2) corresponding to a previous Preamble.

**[0028]** In some examples, the UE may receive more than one Msg3 grants overlapping in time domain. Moreover, the UE may not be able to simultaneously transmit all Msg3s with the required power (e.g., based on the last ramped-up Preamble transmission power). In such examples, the UE may prioritize one RACH access over other. For example, a SI-request may be prioritized over other Random accesses, such that the UE uses the required power for the Msg3 transmission corresponding to the prioritized RACH access and use the remaining power for the other Msg3 transmission. Alternatively, the UE may use equal transmit power for all simultaneous Msg3 transmission. As another alternative, the UE may make a Msg3 transmission only for the higher priority RACH access and send no Msg3 transmission for the other RACH access.

**[0029]** In certain examples, the UE may prioritize one RACH access (as determined above) for an initial Msg3 transmission, but on re-transmission opportunities (e.g. if the Asynchronous re-transmission opportunities still collide) the UE prioritizes the 'other' RACH access instead. In other examples, the UE may use some weighing factor in proportion to their priorities for distributing power for each of the RACH accesses. Here, the network may control the configuration of such "weighing factors".

**[0030]** In some examples, a Scheduling Request ("SR") is used for the UE to request uplink shared channel ("UL-SCH") resources for new transmission. A SR configuration includes a set of PUCCH resources for SR across different bandwidth parts ("BWPs") and cells. Each SR configuration corresponds to one or more logical channels. Each logical channel may be mapped to zero or one SR configuration, e.g., as configured by RRC. Only PUCCH resources on a BWP which is active at the time of SR transmission occasion are considered valid.

**[0031]** After sending a SR, the UE is expected to send a Buffer Status Report ("BSR"). The RAN uses the BSR to schedule an appropriate sized UL grant and the UE sends the UL data on the grant. However, the multiple transmission may cause undesirable/unacceptable delays to the actual data transmission for certain applications. To solve this, in certain examples the UE may send

UL data in place of the BSR, referred to herein as "direct data transmission".

**[0032]** Assume that the UE is configured with a Bearer A associated with URLLC service. Moreover, the UE transmit data directly in place of a BSR for the Bearer A, e.g. as fixed by specification or configured by the network using RRC signalling on a UL grant received in response to a SR configured and subsequently triggered for Bearer A. In one example, the UL grant triggered for Bearer A may directly be used to transmit data for Bearer A if a dedicated SR is configured for Bearer A. In another example, the UL grant triggered for Bearer A may directly be used to transmit data for Bearer A if a dedicated SR is configured for Bearer A and the network configured this bearer such that grant received in response to this SR (next grant received after the SR is sent) can only be used for data transmission from Bearer A. Here, no buffer status report is to be carried on this UL grant unless data for Bearer A is already completely accommodated in the UL grant. Alternatively, the UE may use the UL grant for direct data transmission if a dedicated SR is configured for Bearer A and its logical channel priority is higher than a certain threshold, referred to as *priority\_threshold\_low*. If 'direct data transmission' is configured for certain bearer(s), then the UE may only consider data contained in the corresponding bearer(s) for transmission while performing the LCP (Logical Channel Prioritization) procedure.

**[0033]** In the invention, the UE simultaneously performs SR procedure and RACH procedure for different logical channels. Here, consider a first radio bearer, Bearer A, for which SR is configured (e.g., this bearer has PUCCH resources configured for SR) and a second radio bearer, Bearer B, for which SR is not configured (e.g., this bearer is not configured with PUCCH resources for SR). When UL data arrive for Bearer B, a RACH procedure will be started as no SR is configured for Bearer B. If data in Bearer A arrives in the meantime, and then the data in Bearer A, which could be for URLLC traffic, is delayed unacceptably unless simultaneous/concurrent SR is possible. Accordingly, the UE may trigger and initiate both SR and RACH procedures in parallel.

**[0034]** The mobile communication network may want to restrict the parallel SR and RACH procedures. To do so, it may configure whether the UE, or even certain bearers of a UE, is (or is not) allowed to trigger parallel SR and RACH procedures. Alternatively, parallel SR and RACH procedures may be controlled using logical channel priority levels and a network configured logical channel priority threshold. Here, bearers with priority lower than the certain *priority\_threshold\_high* are not allowed to initiate a RACH procedure if there is a RACH/ SR procedure is already ongoing.

**[0035]** Further, SR in NR might be Bearer/Numerology specific and RACH might be required for other application data configured on a different Numerology for which a SR is not configured. However, in LTE, SR is "UE specific"; when a SR is configured the UE is not allowed to

initiate a RACH procedure to ask for UL grant. Applying UE-specific SR to NR may lead to a starvation/delay of data transmission for a bearer/service for which SR is not configured (for any of the Numerologies mapped to this bearer/service) by the network especially if the Bearer/ Numerology with configured SR resources is configured also for direct data transmission. Accordingly, in various examples the network configures bearers to the same logical channel group ("LCG") only if there is a common numerology (e.g. subcarrier spacing) for bearers mapped to the LCG.

**[0036]** Figure 1 depicts a wireless communication system 100 for handling multiple UL access procedures. In one example, the wireless communication system 100 includes at least one remote unit 105, an access network 120 containing at least two base units 110, wireless communication links 115, and a mobile core network 140. Even though a specific number of remote units 105, access networks 120, base units 110, wireless communication links 115, and mobile core networks 140 are depicted in Figure 1, one of skill in the art will recognize that any number of remote units 105, access networks 120, base units 110, wireless communication links 115, and mobile core networks 140 may be included in the wireless communication system 100. In another example, the access network 120 contains one or more WLAN (e.g., Wi-Fi™) access points.

**[0037]** In one implementation, the wireless communication system 100 is compliant with the 5G system specified in the 3GPP specifications. More generally, however, the wireless communication system 100 may implement some other open or proprietary communication network, for example, LTE or WiMAX, among other networks. The present disclosure is not intended to be limited to the implementation of any particular wireless communication system architecture or protocol.

**[0038]** In one example, the remote units 105 may include computing devices, such as desktop computers, laptop computers, personal digital assistants ("PDAs"), tablet computers, smart phones, smart televisions (e.g., televisions connected to the Internet), smart appliances (e.g., appliances connected to the Internet), set-top boxes, game consoles, security systems (including security cameras), vehicle on-board computers, network devices (e.g., routers, switches, modems), or the like. In some examples, the remote units 105 include wearable devices, such as smart watches, fitness bands, optical head-mounted displays, or the like. Moreover, the remote units 105 may be referred to as subscriber units, mobiles, mobile stations, users, terminals, mobile terminals, fixed terminals, subscriber stations, UE, user terminals, a device, or by other terminology used in the art. The remote units 105 may communicate directly with one or more of the base units 110 via uplink ("UL") and downlink ("DL") communication signals. Furthermore, the UL and DL communication signals may be carried over the wireless communication links 115.

**[0039]** In some examples, the remote units 105 may

communicate with a remote host via a data path that passes through the mobile core network 140 and a data network 150. For example, a remote unit 105 may establish a PDU connection (or a data connection) to the data network 150 via the mobile core network 140 and the access network 120. The mobile core network 140 then relays traffic between the remote unit 105 and the remote host using the PDU connection to the data network 150.

**[0040]** The base units 110 may be distributed over a geographic region. In certain examples, a base unit 110 may also be referred to as an access terminal, an access point, a base, a base station, a Node-B, an eNB, a gNB, a Home Node-B, a relay node, a device, or by any other terminology used in the art. The base units 110 are generally part of a radio access network ("RAN"), such as the access network 120, that may include one or more controllers communicably coupled to one or more corresponding base units 110. These and other elements of the radio access network are not illustrated, but are well known generally by those having ordinary skill in the art. The base units 110 connect to the mobile core network 140 via the access network 120.

**[0041]** The base units 110 may serve a number of remote units 105 within a serving area, for example, a cell or a cell sector via a wireless communication link 115. The base units 110 may communicate directly with one or more of the remote units 105 via communication signals. Generally, the base units 110 transmit DL communication signals to serve the remote units 105 in the time, frequency, and/or spatial domain. Furthermore, the DL communication signals may be carried over the wireless communication links 115. The wireless communication links 115 may be any suitable carrier in licensed or unlicensed radio spectrum. The wireless communication links 115 facilitate communication between one or more of the remote units 105 and/or one or more of the base units 110.

**[0042]** In one example, the mobile core network 140 is a 5G core ("5GC") or the evolved packet core ("EPC"), which may be coupled to a data network 150, like the Internet and private data networks, among other data networks. Each mobile core network 140 may belong to a single public land mobile network ("PLMN"). The present disclosure is not intended to be limited to the implementation of any particular wireless communication system architecture or protocol.

**[0043]** The mobile core network 140 includes several network functions ("NFs"). As depicted, the mobile core network 140 includes multiple control plane functions including, but not limited to, an Access and Mobility Management Function ("AMF") 143, a Session Management Function ("SMF") 145, and a Policy Control Function ("PCF"). Additionally, the mobile core network 140 includes a user plane function ("UPF") 141 and a Unified Data Management ("UDM") 147. Although specific numbers and types of network functions are depicted in Figure 1, one of skill in the art will recognize that any number and type of network functions may be included in the

mobile core network 140.

**[0044]** Disclosed herein are methods, systems, and apparatuses for handling multiple UL access procedures. Arrival of UL data 125 (e.g., generated by an application running on the remote unit 105) triggers SR. If the remote unit 105 is configured with PUCCH resources for SR, then the remote unit 105 may send a SR message 130. Otherwise, the remote unit 105 initiates a RACH procedure in response to arrival of the UL data 125. The base unit 110 identifies that the remote unit 105 requires UL resources and sends the UL grant 135.

**[0045]** In some examples, the UL data 125 arrives while another RACH procedure (e.g., associated with a different bearer) is pending. To minimize delay, the remote unit 105 may send the SR message 130 without waiting to complete the ongoing RACH procedure, thus performing both SR and RACH procedures in parallel. As mentioned above, simultaneous SR transmission may depend on a network configuration, a bearer configuration, a logical channel priority, or the like.

**[0046]** Figure 2 depicts a network procedure 200 for handling multiple UL access procedures, according to the invention. The network procedure 200 involves a UE 205 and a mobile communication network ("MCN") 220. The UE 205 may be one implementation of the remote unit 105, described above. Additionally, the MCN 220 may be one implementation of the access network 120 and mobile core network 140, described above. In various examples, the UE 205 interacts with a base unit 110 in the MCN 220, for example a gNB or other base station.

**[0047]** Here, it is assumed that the UE 205 has established a first radio bearer ("Bearer A" 210) with the MCN 220. In various examples, the first radio bearer may include a first PDCP entity, one or more RLC entities associated with the first PDCP entity, and a first logical channel. It is also assumed that the UE 205 has established a second radio bearer ("Bearer B" 215). Similar to the first radio bearer, the second radio bearer may include a second PDCP entity, one or more RLC entities associated with the second PDCP entity, and a second logical channel. Where the UE 205 is configured to use logical channel groups, it is assumed that Bearer A 210 and Bearer B 215 are associated with different logical channel groups (thus, reporting buffer status independently of one another).

**[0048]** The network procedure 200 begins with the triggering of a scheduling report ("SR") at the UE 205, the triggered SR being associated with the Bearer A 210 (see block 225). In response to the pending (e.g., triggered) SR, the UE 205 determines whether PUCCH resources are configured for Bearer A 210 for the pending SR (e.g., determines whether the logical channel of Bearer A 210 is mapped to a SR configuration). In the depicted embodiment, it is assumed the Bearer A 210 is not mapped to a SR configuration, thus the UE 205 determines that SR is not configured for Bearer A 210 (see block 230).

**[0049]** Because no PUCCH resources are configured for Bearer A 210 for the pending SR, the UE 205 initiates

a random-access procedure (e.g., "RACH procedure") for the SR of Bearer A 210 (see messaging 235). For example, the UE 205 may send a RACH Request in Msg1 when initiating the random-access procedure.

**[0050]** Additionally, while the RACH procedure for Bearer A 210 is pending, the UE 205 also detects the triggering of SR associated with the Bearer B 215 (see block 240). In response to the pending (e.g., triggered) SR for Bearer B 215, the UE 205 determines whether PUCCH resources are configured for Bearer B 215 for the pending SR (e.g., determines whether the logical channel of Bearer B 215 is mapped to a SR configuration). In the depicted embodiment, it is assumed the Bearer B 215 is mapped to a SR configuration, thus the UE 205 determines that SR is configured for Bearer B 215 (see block 245).

**[0051]** Because there is an UL access procedure pending (e.g., the RACH procedure for Bearer A 210), the UE 205 determines whether simultaneous SR transmission is allowed. For example, the UE 205 may determine whether simultaneous SR transmission is permitted in the mobile communication network 220, whether a logical channel priority of Bearer B 215 is sufficient to permit simultaneous SR transmission, and/or determine whether a configuration of Bearer B 215 permits simultaneous SR transmission. Moreover, the UE 205 may determine whether an amount of transmission power is sufficient to simultaneously transmit messages for the RACH procedure for Bearer A 210 and the scheduling request message for Bearer B 215 in parallel. In the depicted embodiment, it is assumed that simultaneous SR transmission is allowed (e.g., permitted and sufficient transmission power is available, see block 250).

**[0052]** Because Bearer B 215 is mapped to a SR configuration, the UE 205 transmits a SR message for Bearer B 215 using configured PUCCH resources (see messaging 255). Note that the UE 205 transmits the SR message for Bearer B 215 prior to completing the RACH procedure for Bearer A 210. In the depicted example, the UE 205 receives a RACH response (e.g., for Bearer A 210) at some time after transmitting the SR message for Bearer B 215 (see messaging 260).

**[0053]** While the depicted embodiment assumes that Bearer A 210 has no SR configuration, in other examples which are not claimed the Bearer A 210 is configured with PUCCH resources for pending SR. In such examples, the UE 205 may instead send a SR message for Bearer A 210, rather than initiating the RACH procedure for Bearer A 210 as depicted. Here, the UE 205 may also send the SR message for Bearer B 215 prior to receiving a response to the SR message for Bearer A 210. In certain examples which are not claimed, the UE 205 may send SR messages for Bearer A 210 and Bearer B 215 in parallel.

**[0054]** Moreover, while the depicted embodiment assumes that Bearer B 215 has a SR configuration, in other examples which are not claimed the Bearer B 215 is not configured with PUCCH resources for pending SR. In

such examples, the UE 205 may instead initiate a second RACH procedure for Bearer B 215, rather than sending a SR message on configured PUCCH resources as depicted. In certain examples which are not claimed, the UE 205 may initiate RACH procedures for Bearer A 210 and Bearer B 215 in parallel.

**[0055]** While the depicted embodiment assumes that simultaneous SR transmission is allowed, in other examples simultaneous SR transmission may not be allowed. In such examples, the UE 205 may optionally cancel the RACH procedure for Bearer A 210 to send the SR message (or initiate a second RACH procedure) for Bearer B 215, e.g., due to the logical channel priority of Bearer B 215 being higher than that of Bearer A 210. In certain examples where simultaneous SR transmission is not allowed, the UE 205 may optionally delay the SR message (or second RACH procedure) for Bearer B 215 until completion of the RACH procedure for Bearer A 210, e.g., due to a logical channel priority of Bearer B 215 being lower than or equal to that of Bearer A 210. Other examples are also possible, as described herein.

**[0056]** Figure 3 depicts one example of a user equipment apparatus 300 that may be used for handling multiple UL access procedures. The user equipment apparatus 300 may be one implementation of the remote unit 105 and/or UE 205. Furthermore, the user equipment apparatus 300 may include a processor 305, a memory 310, an input device 315, an output device 320, and a transceiver 325. In some examples, the input device 315 and the output device 320 are combined into a single device, such as a touch screen. In certain examples, the user equipment apparatus 300 does not include any input device 315 and/or output device 320.

**[0057]** Via the transceiver 325, the user equipment apparatus 300 establishes at least two radio bearers. As discussed above, each radio bearer may be associated with a different logical channel. As depicted, the transceiver 325 includes at least one transmitter 330 and at least one receiver 335. Additionally, the transceiver 325 may support at least one network interface 340. Here, the at least one network interface 340 facilitates communication with an eNB or gNB (e.g., using the Uu interface). Additionally, the at least one network interface 340 may include an interface used for communications with an UPF and/or AMF.

**[0058]** The processor 305, in one example, may include any known controller capable of executing computer-readable instructions and/or capable of performing logical operations. For example, the processor 305 may be a microcontroller, a microprocessor, a central processing unit ("CPU"), a graphics processing unit ("GPU"), an auxiliary processing unit, a field programmable gate array ("FPGA"), or similar programmable controller. In some examples, the processor 305 executes instructions stored in the memory 310 to perform the methods and routines described herein. The processor 305 is communicatively coupled to the memory 310, the input device 315, the output device 320, and the trans-

ceiver 325.

**[0059]** In various examples, the processor 305 initiates a first UL access procedure for a first radio bearer. Here, the first UL access procedure may be a random-access procedure, such as the RACH procedure discussed above. In other examples, the first UL access procedure may be a SR request transmitted on PUCCH resources configured for a logical channel associated with the first radio bearer.

**[0060]** Moreover, the processor 305 may receive a SR trigger for a second radio bearer while the first UL access procedure (e.g., random-access) request remains pending. Here, the SR trigger may be the arrival of UL data associated with the second radio bearer. Note that it is assumed that the first and second radio bearers are not a part of the same logical channel group. Thus, the second radio bearer reports its buffer status independently of the first radio bearer.

**[0061]** In such examples, the processor 305 controls the transceiver 325 to transmit a first SR message for the second radio bearer prior to completing the first uplink access procedure. In some examples, the processor 305 determines whether simultaneous SR transmission is permitted in response to receiving the SR trigger while the first UL access procedure remains pending. In certain examples, simultaneous SR transmission is defined as permitted in the mobile communication network. In other examples, simultaneous SR transmission may be permitted if a logical channel priority of the second radio bearer is above a threshold level. In further examples, simultaneous SR transmission may be permitted based on the configuration of the second radio bearer.

**[0062]** In response to determining that simultaneous SR transmission is permitted, the processor 305 controls the transceiver 325 to transmit a first SR message for the second radio bearer. In various examples, the processor 305 determines whether the second radio bearer is configured with PUCCH resources for transmitting SR. Where PUCCH resources are configured for SR, then transmitting the first SR message for the second radio bearer includes transmitting a scheduling request (e.g., an uplink PHY layer message) using one of the configured PUCCH resources. Otherwise, if no PUCCH resources are configured for SR for the second radio bearer, then transmitting the first SR message for the second radio bearer may include initiating a RACH procedure (e.g., transmitting a RACH Request in Msg1).

**[0063]** In some examples, determining whether simultaneous SR transmission is permitted may include the processor 305 identifying a logical channel priority associated with the second radio bearer. Moreover, the processor 305 may compare the logical channel priority of the second radio bearer to a priority threshold, where the processor 305 determines that simultaneous SR transmission is permitted if the logical channel priority exceeds the priority threshold.

**[0064]** As mentioned, in certain examples the processor 305 uses a configuration of the second radio bearer

to determine whether simultaneous scheduling request transmission is permitted. In other examples, the mobile communication network defines simultaneous scheduling request transmission as being permitted, therefore the processor 305 may always determine that simultaneous SR is permitted.

**[0065]** Where simultaneous SR transmission is permitted, the processor 305 may determine whether an amount of transmission power is sufficient to simultaneously transmit messages for the first UL access procedure and the first SR message in parallel. In certain examples, the transmitting the first scheduling request message for the second radio bearer may include reducing power of a message of a lower priority of the first radio bearer and second radio bearer.

**[0066]** In some examples, the processor 305 determines a first logical channel priority of the first radio bearer and a second logical channel priority of the second radio bearer in response to simultaneous scheduling request transmission not being permitted and cancels the first UL access procedure in response to the first logical channel priority being lower than the second logical channel priority. For example, if simultaneous SR transmission is not permitted, then the processor 305 may determine to cancel the first UL access procedure to avoid delaying the first SR message. Beneficially, this would allow SR messaging associated with critical services, such as public safety, vehicular telematics/control, emergency alerts, and the like, to have priority over other services.

**[0067]** In certain examples, the processor 305 may receive (e.g., via the transceiver 325) an uplink grant for a buffer status report in response the first SR message. In such embodiments, the processor 305 may optionally send uplink data in place of a buffer status report on the grant. In certain examples, the processor 305 may select an appropriate MAC control element ("CE") subheader to indicate that uplink data is sent in place of the buffer status report.

**[0068]** In some examples, the processor 305 may receive (e.g., via the transceiver 325) a backoff indicator message. As understood in the art, a backoff indicator prohibits any RACH attempts for an indicated amount of time. In such examples, the backoff indicator message may include one or more service identifier fields. Here, the processor 305 initiates a backoff timer for an amount of time based on the backoff indicator message only for the specific service(s) indicated by the service identifier field. In one example, the service identifier field is a positive list wherein a backoff timer is initiated for the identified service(s). In another example, the service identifier field is a negative list wherein a backoff timer is initiated all services but the identified service(s). Moreover, in various examples, the backoff indicator message may include a plurality of service identifier fields.

**[0069]** In some examples, the processor 305 receives a trigger for a first RACH request, while a second RACH procedure is pending. Here, the processor 305 may iden-

tify a first priority of the first RACH request and second priority of the second RACH procedure. If both the first priority and the second priority are high, then the processor 305 may control the transceiver 325 to transmit the first RACH request prior to completion of the second RACH procedure. In one example, a RACH message requesting a SIB may be considered a high priority, while a RACH message requesting an upload grant may be considered lower priority. In another example, only a RACH message requesting a critical-service SIB may be considered a high priority. Here, critical services may include, but are not limited to, emergency alerts (e.g., Commercial Mobile Alert System ("CMAS"), Wireless Emergency Alerts ("WEA"), Earthquake and Tsunami Warning System ("ETWS"), or other disaster notification systems), vehicular control/telematics, and public safety services.

**[0070]** In certain examples, the processor 305 may abort (cancel) the second (e.g., already pending) RACH procedure, e.g., in response to the first priority being high and the second priority being low. In other examples, the processor 305 may delay transmission of the first RACH request until completion of the second RACH procedure.

**[0071]** In some examples, the first priority and the second priority may have the same priority level. In such examples, the processor 305 may identify a next RACH opportunity and control the transceiver 325 to transmit the first RACH request comprises transmitting during the next RACH opportunity, even if the next RACH opportunity comes prior to receiving a response for the second random-access procedure.

**[0072]** In certain examples, transmitting the first RACH request includes simultaneously transmitting a first RACH preamble corresponding to the first RACH request and a second RACH preamble corresponding to the pending second RACH procedure. Moreover, the processor 305 may receive a first RACH response corresponding to the first RACH request and a second RACH response corresponding to the second RACH procedure, each RACH response including a RACH grant, wherein the RACH grants overlap in time. In such examples, the processor 305 may reduce a transmit power of a third RACH message for a lower priority of the first RACH request and the second RACH procedure due to the RACH grants overlapping in time.

**[0073]** In one example, the processor 305 may reduce the transmit power of a retransmission opportunity of the lower priority of the first RACH request and the second RACH procedure in response to reducing the transmit power of the third RACH message for the lower priority of the first RACH request and the second RACH procedure. In certain examples, an amount of power reduction of the third message is based on a weighing factor. Here, the weighing factor may be selected based on the relative priority of the first priority compared to the second priority.

**[0074]** The memory 310, in one example, is a computer readable storage medium. In some examples, the memory 310 includes volatile computer storage media. For example, the memory 310 may include a RAM, including

dynamic RAM ("DRAM"), synchronous dynamic RAM ("SDRAM"), and/or static RAM ("SRAM"). In some examples, the memory 310 includes non-volatile computer storage media. For example, the memory 310 may include a hard disk drive, a flash memory, or any other suitable non-volatile computer storage device. In some examples, the memory 310 includes both volatile and non-volatile computer storage media. In some examples, the memory 310 stores data relating to handling multiple UL access procedures, for example storing bearer configurations, SR configurations, logical channel priorities, backoff indicators, and the like. In certain examples, the memory 310 also stores program code and related data, such as an operating system or other controller algorithms operating on the user equipment apparatus 300 and one or more software applications.

**[0075]** The input device 315, in one example, may include any known computer input device including a touch panel, a button, a keyboard, a stylus, a microphone, or the like. In some examples, the input device 315 may be integrated with the output device 320, for example, as a touchscreen or similar touch-sensitive display. In some examples, the input device 315 includes a touchscreen such that text may be input using a virtual keyboard displayed on the touchscreen and/or by handwriting on the touchscreen. In some examples, the input device 315 includes two or more different devices, such as a keyboard and a touch panel.

**[0076]** The output device 320, in one example, may include any known electronically controllable display or display device. The output device 320 may be designed to output visual, audible, and/or haptic signals. In some examples, the output device 320 includes an electronic display capable of outputting visual data to a user. For example, the output device 320 may include, but is not limited to, an LCD display, an LED display, an OLED display, a projector, or similar display device capable of outputting images, text, or the like to a user. As another, non-limiting, example, the output device 320 may include a wearable display such as a smart watch, smart glasses, a heads-up display, or the like. Further, the output device 320 may be a component of a smart phone, a personal digital assistant, a television, a table computer, a notebook (laptop) computer, a personal computer, a vehicle dashboard, or the like.

**[0077]** In certain examples, the output device 320 includes one or more speakers for producing sound. For example, the output device 320 may produce an audible alert or notification (e.g., a beep or chime). In some examples, the output device 320 includes one or more haptic devices for producing vibrations, motion, or other haptic feedback. In some examples, all or portions of the output device 320 may be integrated with the input device 315. For example, the input device 315 and output device 320 may form a touchscreen or similar touch-sensitive display. In other examples, all or portions of the output device 320 may be located near the input device 315.

**[0078]** The transceiver 325 communicates with one or

more network functions of a mobile communication network. The transceiver 325 operates under the control of the processor 305 to transmit messages, data, and other signals and also to receive messages, data, and other signals. For example, the processor 305 may selectively activate the transceiver (or portions thereof) at particular times in order to send and receive messages. The transceiver 325 may include one or more transmitters 330 and one or more receivers 335.

**[0079]** Figure 4 depicts a network equipment apparatus 400 that may be used for handling multiple UL access procedures. The network equipment apparatus 400 may be one implementation of the base unit 110 and/or the gNB 210. Furthermore, the network equipment apparatus 400 may include a processor 405, a memory 410, an input device 415, an output device 420, and a transceiver 425. In some examples, the input device 415 and the output device 420 are combined into a single device, such as a touch screen. In certain examples, the network equipment apparatus 400 does not include any input device 415 and/or output device 420.

**[0080]** As depicted, the transceiver 425 includes at least one transmitter 430 and at least one receiver 435. Additionally, the transceiver 425 may support at least one network interface 440. Here, the at least one network interface 440 facilitates communication with a remote unit 105, such as the UE 205, with other network functions in a mobile core network 140, such as the UPF 141, AMF 143, and the like.

**[0081]** The processor 405, in one example, may include any known controller capable of executing computer-readable instructions and/or capable of performing logical operations. For example, the processor 405 may be a microcontroller, a microprocessor, a central processing unit ("CPU"), a graphics processing unit ("GPU"), an auxiliary processing unit, a field programmable gate array ("FPGA"), or similar programmable controller. In some examples, the processor 405 executes instructions stored in the memory 410 to perform the methods and routines described herein. The processor 405 is communicatively coupled to the memory 410, the input device 415, the output device 420, and the transceiver 425.

**[0082]** In various examples, the processor 405 establishes at least two radio bearers to communicate with a UE, such as the UE 205. Here, each radio bearer may include a PDCP protocol entity, at least one RLC protocol entity associated with said PDCP protocol entity, and an associated logical channel. In certain examples, the processor 405 may configure a radio bearer with PUCCH resources for transmitting SR.

**[0083]** In some examples, the processor 405 receives a UL access request from a UE. Here, the UL access request may be a SR send on configured PUCCH resources or a RACH procedure. In response to the UL access request, the processor 405 may then schedule UL resources to the UE for communicating a buffer status report and indicate the UL resources by sending a UL

grant message to the UE. In certain examples, the processor 405 may receive UL data in the UL grant in place of the buffer status report. In one example, a MAC CE subheader associated with the UL grant indicates that the UE is sending UL data rather than a buffer status report.

**[0084]** In some examples, the processor 405 may send a backoff indicator message to the UE in response to the UL access request. In such examples, the backoff indicator message may include one or more service identifier fields. Here, the processor 405 identifies one or more the specific services using the service identifier field. Upon receiving the backoff indicator message, the UE imitates a backoff timer.

**[0085]** In one example, the service identifier field is a positive list wherein a backoff timer is initiated for the identified service(s). In another example, the service identifier field is a negative list wherein a backoff timer is initiated all services but the identified service(s). Moreover, in various examples, the backoff indicator message may include a plurality of service identifier fields.

**[0086]** The memory 410, in one example, is a computer readable storage medium. In some examples, the memory 410 includes volatile computer storage media. For example, the memory 410 may include a RAM, including dynamic RAM ("DRAM"), synchronous dynamic RAM ("SDRAM"), and/or static RAM ("SRAM"). In some embodiments, the memory 410 includes non-volatile computer storage media. For example, the memory 410 may include a hard disk drive, a flash memory, or any other suitable non-volatile computer storage device. In some examples, the memory 410 includes both volatile and non-volatile computer storage media. In some examples, the memory 410 stores data relating to handling multiple UL access procedures, for example storing bearer configurations, SR configurations, backoff indicators, and the like. In certain examples, the memory 410 also stores program code and related data, such as an operating system or other controller algorithms operating on the network equipment apparatus 400 and one or more software applications.

**[0087]** The input device 415, in one example, may include any known computer input device including a touch panel, a button, a keyboard, a stylus, a microphone, or the like. In some examples, the input device 415 may be integrated with the output device 420, for example, as a touchscreen or similar touch-sensitive display. In some examples, the input device 415 includes a touchscreen such that text may be input using a virtual keyboard displayed on the touchscreen and/or by handwriting on the touchscreen. In some examples, the input device 415 includes two or more different devices, such as a keyboard and a touch panel.

**[0088]** The output device 420, in one example, may include any known electronically controllable display or display device. The output device 420 may be designed to output visual, audible, and/or haptic signals. In some examples, the output device 420 includes an electronic

display capable of outputting visual data to a user. For example, the output device 420 may include, but is not limited to, an LCD display, an LED display, an OLED display, a projector, or similar display device capable of outputting images, text, or the like to a user. As another, non-limiting, example, the output device 420 may include a wearable display such as a smart watch, smart glasses, a heads-up display, or the like. Further, the output device 420 may be a component of a smart phone, a personal digital assistant, a television, a table computer, a notebook (laptop) computer, a personal computer, a vehicle dashboard, or the like.

**[0089]** In certain examples, the output device 420 includes one or more speakers for producing sound. For example, the output device 420 may produce an audible alert or notification (e.g., a beep or chime). In some examples, the output device 420 includes one or more haptic devices for producing vibrations, motion, or other haptic feedback. In some examples, all or portions of the output device 420 may be integrated with the input device 415. For example, the input device 415 and output device 420 may form a touchscreen or similar touch-sensitive display. In other examples, all or portions of the output device 420 may be located near the input device 415.

**[0090]** The transceiver 425 operates under the control of the processor 405 to transmit messages, data, and other signals and also to receive messages, data, and other signals. For example, the processor 405 may selectively activate the transceiver (or portions thereof) at particular times in order to send and receive messages. The transceiver 425 may include one or more transmitters 430 and one or more receivers 435.

**[0091]** Figure 5 depicts various examples of enhanced backoff indicator messages. In certain examples, the enhanced backoff indicator messages form part of a MAC header or subheader. Here, an LTE backoff indicator message 500 is depicted having a plurality of fields (having an 'E/T/R/R/BI' format). The 'E' field is a 1-bit field that indicates whether there is another subheader following the present subheader or not. For example, a value of '1' may indicate there is at least one following subheader, while a value of '0' may indicate there are no more subheaders, implying that the next byte is the start byte of MAC SDU or MAC CE or Padding. The 'T' field (type field) is a 1-bit field that may be used to distinguish a backoff indicator message from another MAC header/subheader. For example, in LTE, the 'T' field is used to distinguish a subheader containing a backoff indicator from a subheader containing a Random-Access ID. The 'R' fields are reserved in LTE and the 'BI' field (backoff indicator field) is a 4-bit field that indicates an amount of time the UE is to wait before initiating a RACH procedure.

**[0092]** Because 5G networks are expected to serve different "verticals," e.g., by supporting different network slices that reserve appropriate resources in the network, different verticals or services may have different requirements and different QOS characteristics (referred to as '5QI'), including priorities and preemption possibility. Ad-

ditionally, a mobile communication network has certain capacity of how many UEs (load) it can handle and when loaded it may need to take appropriate action including barring certain UEs (e.g., Access Classes), prohibiting RACH access, releasing some RRC Connected UEs etc. One mechanism to prohibit RACH access is to send a backoff indicator, causing the UE to forgo any RACH attempts for a certain Backoff timer. In 5G, however, for some verticals/services it is quite important to be minimize delay.

**[0093]** In a first enhanced backoff indicator message 505, the reserved fields of the LTE message are replaced with a Service ID ('SID') field used to identify a particular service associated with the backoff indicator. In various examples, the UE does not backoff all services simultaneously in response to the backoff indicator message/subheader, but instead initiates a backoff timer for the identified service. In the first enhanced backoff indicator message 505 the SID field is a 2-bit field which can signal up to four different services. When reading the first enhanced backoff indicator message 505, the UE notes that the type field ('T') indicates a backoff indicator and reads the following two bits to identify the service to back-off.

**[0094]** In the second enhanced backoff indicator 510 and third enhanced backoff indicator 515, the 'T' field and a reserved field of the LTE message are replaced with an extended type field ('Extended-T'). Here, the extended type field is a 2-bit field which can signal up to four different meanings. A first value may be used to indicate that the MAC subheader contains a Random-Access ID. A second value may be used to indicate that the MAC subheader contains a backoff indicator for all services (e.g., no SID included). A third value may be used to indicate that the MAC subheader contains a backoff indicator and a positive list of SIDs. A fourth value may be used to indicate that the MAC subheader contains a backoff indicator and a negative list of SIDs. As used here, a positive list means that the backoff indicator is applicable to each listed service, while a negative list means that the backoff indicator is applicable to all services except those listed.

**[0095]** Note that the backoff indicator messages with SID lists comprise two or more bytes. Here, the second enhanced backoff indicator 510 and third enhanced backoff indicator 515 are both two-byte messages with the SID lists taking up one byte. Moreover, the SID field may be any suitable size. In the second enhanced backoff indicator 510 each SID field is a 2-bit field used to identify one of up to four different services. In the third enhanced backoff indicator 515 each SID field is a 4-bit field used to identify one of up to 16 different services.

**[0096]** The disclosed enhanced backoff indicator is not to be limited to the depicted examples. In some examples, the SID field is used to indicate an "Access Reason Identifier" rather than a specific service. For example, a first value may correspond to a beam failure recovery request, a second value may correspond to a URLLC

application, and a third value may correspond to a SI request, with the fourth value being applicable to all other access reasons. In a further example, the mobile communication network may be configured to never back off one of a beam failure recovery request, URLLC application, or SI request. In such a situation, a value of the SID field may then correspond to eMBB data. In other examples, the SID field may apply to other categories of services/applications.

**[0097]** In certain examples, the value in the 'BI' field (backoff indicator field) may apply differently to different services, applications, or access reasons. For example, the SIB may indicate scale factors applicable to the different services/application/access reasons. Here, the scale factor may be applied to the backoff indicator to shorten or extend the backoff time. In other examples, separate backoff indicator messages/subheaders may be sent so that different services/application/access reasons are backed off differently.

**[0098]** Figure 6 depicts a method 600 for handling multiple UL access procedures. In some examples, the method 600 is performed by a remote unit, such as the remote unit 105, the UE 205, and/or the user equipment apparatus 300, described above. In some examples, the method 600 is performed by a processor executing program code, for example, a microcontroller, a microprocessor, a CPU, a GPU, an auxiliary processing unit, a FPGA, or the like.

**[0099]** The method 600 begins and initiates 605 a first random-access procedure for a first radio bearer. Here, the first radio bearer may be associated with a first logical channel and report its buffer status independently of a second radio bearer. The method 600 includes receiving 610 a SR trigger for the second radio bearer while the first random-access procedure remains pending.

**[0100]** The method 600 includes transmitting 615, to a mobile communication network, a first SR message for the second radio bearer prior to completing the first random-access procedure. The method 600 ends. In embodiments, the second radio bearer is configured with PUCCH resources for pending SR. Here, transmitting 615 the first SR message includes sending the scheduling request on the configured PUCCH resources. In an example, the second radio bearer is not configured with PUCCH resources for pending SR. Here, transmitting 615 the first SR message includes initiating a second random-access procedure.

**[0101]** Figure 7 depicts a method 700 for handling multiple UL access procedures. In some examples, the method 700 is performed by a remote unit, such as the remote unit 105, the UE 205, and/or the user equipment apparatus 300, described above. In some examples, the method 700 is performed by a processor executing program code, for example, a microcontroller, a microprocessor, a CPU, a GPU, an auxiliary processing unit, a FPGA, or the like.

**[0102]** The method 700 begins and initiates 705 a first random-access procedure for a first radio bearer. Here,

the first radio bearer may be associated with a first logical channel and report its buffer status independently of a second radio bearer. The method 700 includes receiving 710 a SR trigger for the second radio bearer while the first random-access procedure remains pending. Here, the SR trigger may be due to receiving UL data for the second radio bearer.

**[0103]** The method 700 include determining 715 whether simultaneous SR is permitted. In one example, the mobile communication network defines simultaneous SR transmission as being permitted. In other examples, determining 715 whether simultaneous SR transmission is permitted is based on a configuration of the second radio bearer. In certain examples, determining 715 whether simultaneous SR transmission is permitted comprises identifying a logical channel priority associated with the second radio bearer. Here, simultaneous SR transmission may be permitted if the logical channel priority exceeds a priority threshold.

**[0104]** The method 700 includes transmitting 720, to a mobile communication network, a first SR message for the second radio bearer prior to completing the first random-access procedure in response to simultaneous scheduling request transmission being permitted. The method 700 ends. In some examples, transmitting 720 the first SR message for the second radio bearer may include reducing power of a message of a lower priority of the first radio bearer and second radio bearer. For example, the apparatus may determine whether an amount of transmission power is sufficient to simultaneously transmit messages for the first random-access procedure and the first scheduling request message in parallel and reduce the power of the lower priority message based on the determination.

**[0105]** In examples, the second radio bearer is configured with PUCCH resources for pending SR. Here, transmitting 720 the first SR message includes sending the scheduling request on the configured PUCCH resources. In an example, the second radio bearer is not configured with PUCCH resources for pending SR. Here, transmitting 720 the first SR message includes initiating a second random-access procedure.

**[0106]** Figure 8 depicts a method 800 for handling multiple UL access procedures. In some examples, the method 800 is performed by a remote unit, such as the remote unit 105, the UE 205, and/or the user equipment apparatus 300, described above. In some examples, the method 800 is performed by a processor executing program code, for example, a microcontroller, a microprocessor, a CPU, a GPU, an auxiliary processing unit, a FPGA, or the like.

**[0107]** The method 800 begins and receives 805 a trigger for a first RACH request, while a second RACH procedure is pending. In one example, the trigger for a first RACH request is due to UL data arrival. In another example, the first RACH request is a System Information request, e.g., to request a SIB.

**[0108]** The method 800 includes identifying 810 a first

priority of the first RACH request and second priority of the second RACH procedure. In certain examples, a request for a SIB has higher priority than another type of RACH request. In some examples, the first priority and the second priority are the same priority level.

**[0109]** The method 800 includes transmitting 815 the first RACH request prior to completion of the second RACH procedure in response to both the first priority and the second priority being high. The method 800 ends. In some examples, transmitting 815 the first RACH request includes transmitting the first RACH request during a next RACH opportunity prior to receiving a response for the second random-access procedure. In certain examples, transmitting 815 the first RACH request includes simultaneously transmitting a first RACH preamble corresponding to the first RACH request and a second RACH preamble corresponding to the pending second RACH procedure.

**[0110]** The detailed description is to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description.

## Claims

1. A method (700) in a user equipment, the method comprising:

initiating (705) a first random-access procedure for a first radio bearer, wherein the first radio bearer is associated with a first logical channel and is not configured with any physical uplink control channel resource for scheduling request messaging;

receiving (710) a scheduling request trigger for a second radio bearer while the first random-access procedure remains pending, the second radio bearer being associated with a second logical channel different than the first logical channel, wherein the second radio bearer is configured with physical uplink control channel resources for scheduling request messaging;

determining (715) whether simultaneous scheduling request transmission is permitted for the second bearer in response to the first random-access procedure being pending; and transmitting (720) a first scheduling request message for the second radio bearer to a mobile communication network using physical uplink control channel resources configured for scheduling request messaging in response to simultaneous scheduling request transmission being permitted for the second bearer.

2. The method (700) of claim 1, wherein determining (715) whether simultaneous scheduling request transmission is permitted comprises identifying a

logical channel priority associated with the second radio bearer.

3. The method (700) of claim 2, further comprising comparing the logical channel priority associated with the second radio bearer to a first priority threshold, wherein simultaneous scheduling request transmission is permitted if the logical channel priority exceeds the first priority threshold.

4. The method (700) of claim 1, wherein determining (715) whether simultaneous scheduling request transmission is permitted is based on a configuration of the second radio bearer.

5. The method (700) of claim 1, wherein the mobile communication network defines simultaneous scheduling request transmission as being permitted.

6. The method (700) of claim 1, further comprising determining whether an amount of transmission power is sufficient to simultaneously transmit messages for the first random-access procedure and the first scheduling request message in parallel, in response to simultaneous scheduling request transmission being permitted, wherein transmitting the first scheduling request message for the second radio bearer comprises reducing power of a message of a lower priority of the first radio bearer and second radio bearer.

7. The method (700) of claim 1, further comprising:

determining a first logical channel priority of the first radio bearer and a second logical channel priority of the second radio bearer in response to simultaneous scheduling request transmission not being permitted; and  
cancelling the first random-access procedure in response to the first logical channel priority being lower than the second logical channel priority.

8. The method (700) of claim 1, wherein the second radio bearer is not configured with any physical uplink control channel resource for the first scheduling request message, wherein transmitting the first scheduling request message comprises initiating a second random-access procedure.

9. The method (700) of claim 1, further comprising:

receiving a buffer status report grant for a buffer status report in response the first scheduling request message; and  
transmitting uplink data on the buffer status report grant.

10. The method (700) of claim 1, further comprising:

receiving a backoff indicator message, the backoff indicator message including a service identifier field; and  
initiating a backoff timer for a specific service for an amount of time based on the backoff indicator message.

11. The method (700) of claim 10, wherein the backoff indicator message includes a plurality of service identifier fields, wherein the backoff indicator applies to each service identified in the plurality of service identifier fields.

12. The method (700) of claim 10, wherein the backoff indicator message includes a plurality of service identifier fields, wherein the backoff indicator applies to all services except those identified in the plurality of service identifier fields.

13. An apparatus (300) comprising:

a transceiver (325) adapted to communicate with a mobile communication network using a plurality of radio bearers; and  
a processor (305) adapted to: initiate a first random-access procedure for a first radio bearer, wherein the first radio bearer is associated with a first logical channel and is not configured with any physical uplink control channel resource for scheduling request messaging;  
receive a scheduling request trigger for a second radio bearer while the first random-access procedure remains pending, the second radio bearer being associated with a second logical channel different than the first logical channel, wherein the second radio bearer is configured with physical uplink control channel resources for scheduling request messaging;  
determine whether simultaneous scheduling request transmission is permitted for the second bearer in response to the first random-access procedure being pending; and  
transmit a first scheduling request message for the second radio bearer using physical uplink control channel resources configured for scheduling request messaging in response to simultaneous scheduling request transmission being permitted for the second bearer.

14. The apparatus (300) of claim 13, wherein the processor is adapted to determine whether simultaneous scheduling request transmission is permitted by identifying a logical channel priority associated with the second radio bearer, wherein simultaneous scheduling request transmission is permitted if the logical channel priority exceeds a priority threshold.

15. The apparatus (300) of claim 13, wherein the processor (305) is adapted to use a configuration of the second radio bearer to determine whether simultaneous scheduling request transmission is permitted.

16. The apparatus (300) of claim 13, wherein the mobile communication network defines simultaneous scheduling request transmission as being permitted.

17. The apparatus (300) of claim 13, wherein the processor (305) further adapted to:

determine a first logical channel priority of the first radio bearer and a second logical channel priority of the second radio bearer in response to simultaneous scheduling request transmission not being permitted; and  
cancel the first random-access procedure in response to the first logical channel priority being lower than the second logical channel priority.

18. The apparatus (300) of claim 13, wherein the transceiver (325) is adapted to receive a backoff indicator message, the backoff indicator message including a service identifier field, wherein the processor initiates a backoff timer for a specific service for an amount of time based on the backoff indicator message.

19. The apparatus (300) of claim 18, wherein the backoff indicator message includes a plurality of service identifier fields, wherein the backoff indicator applies to each service identified in the plurality of service identifier fields.

#### Patentansprüche

1. Verfahren (700) in einer Benutzereinrichtung, wobei das Verfahren Folgendes umfasst:

Auslösen (705) einer ersten Vorgehensweise mit wahlfreiem Zugriff für einen ersten Funkträger, wobei der erste Funkträger mit einem ersten logischen Kanal verknüpft ist und nicht mit einem beliebigen physischen Uplink-Steuerkanalressource zum Durchführen einer Ablaufsteuerungsanfragevermittlung konfiguriert ist; Empfangen (710) eines Ablaufsteuerungsanfrageauslösers für einen zweiten Funkträger, während die erste Vorgehensweise mit wahlfreiem Zugriff anstehend bleibt, wobei der zweite Funkträger mit einem zweiten logischen Kanal verknüpft ist, der sich von dem ersten logischen Kanal unterscheidet, wobei der zweite Funkträger mit physischen Uplink-Steuerkanalressourcen zum Durchführen der Ablaufsteuerungsanfragevermittlung konfiguriert ist;

Bestimmen (715), ob eine gleichzeitige Ablaufsteuerungsanfrageübertragung für den zweiten Träger als Reaktion darauf, dass die erste Vorgehensweise mit wahlfreiem Zugriff anstehend ist, zulässig ist; und

Übertragen (720) einer ersten Ablaufsteuerungsanfragenachricht für den zweiten Funkträger an ein Mobilkommunikationsnetz unter Verwendung von physischen Uplink-Steuerkanalressourcen, die zum Durchführen der Ablaufsteuerungsanfragevermittlung als Reaktion darauf, dass die gleichzeitige Ablaufsteuerungsanfrageübertragung für den zweiten Träger zulässig ist, konfiguriert sind.

2. Verfahren (700) nach Anspruch 1, wobei das Bestimmen (715), ob die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, ein Identifizieren einer logischen Kanalpriorität umfasst, die mit dem zweiten Funkträger verknüpft ist.

3. Verfahren (700) nach Anspruch 2, das ferner ein Vergleichen der logischen Kanalpriorität, die mit dem zweiten Funkträger verknüpft ist, mit einer ersten Prioritätsschwelle umfasst, wobei die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, wenn die logische Kanalpriorität die erste Prioritätsschwelle überschreitet.

4. Verfahren (700) nach Anspruch 1, wobei das Bestimmen (715), ob die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, auf einer Konfiguration des zweiten Funkträgers basiert.

5. Verfahren (700) nach Anspruch 1, wobei das Mobilkommunikationsnetz die gleichzeitige Ablaufsteuerungsanfrageübertragung als zulässig definiert.

6. Verfahren (700) nach Anspruch 1, das ferner das Bestimmen, ob eine Menge an Übertragungsleistung ausreicht, um als Reaktion darauf, dass die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, gleichzeitig Nachrichten für die erste Vorgehensweise mit wahlfreiem Zugriff und die erste Ablaufsteuerungsanfragenachricht parallel zu übertragen, umfasst, wobei das Übertragen der ersten Ablaufsteuerungsanfragenachricht für den zweiten Funkträger ein Reduzieren einer Leistung einer Nachricht mit einer niedrigeren Priorität des ersten Funkträgers und des zweiten Funkträgers umfasst.

7. Verfahren (700) nach Anspruch 1, das ferner Folgendes umfasst:

Bestimmen einer ersten logischen Kanalpriorität des ersten Funkträgers und einer zweiten logischen Kanalpriorität des zweiten Funkträgers als Reaktion darauf, dass die gleichzeitige

- Ablaufsteuerungsanfrageübertragung nicht zulässig ist; und  
 Abbrechen der ersten Vorgehensweise mit wahlfreiem Zugriff als Reaktion darauf, dass die erste logische Kanalpriorität niedriger als die zweite logische Kanalpriorität ist. 5
8. Verfahren (700) nach Anspruch 1, wobei der zweite Funkträger nicht mit einer beliebigen physischen Uplink-Steuerkanalressource für die erste Ablaufsteuerungsanfragenachricht konfiguriert ist, wobei das Übertragen der ersten Ablaufsteuerungsanfragenachricht das Auslösen einer zweiten Vorgehensweise mit wahlfreiem Zugriff umfasst. 10
9. Verfahren (700) nach Anspruch 1, das ferner Folgendes umfasst: 15
- Empfangen einer Pufferstatusberichtsgewährung für einen Pufferstatusbericht als Reaktion auf die erste Ablaufsteuerungsanfragenachricht; und 20
- Übertragen von Uplink-Daten auf der Pufferstatusberichtsgewährung. 25
10. Verfahren (700) nach Anspruch 1, das ferner Folgendes umfasst: 30
- Empfangen einer Backoff-Kennzeichennachricht, wobei die Backoff-Kennzeichennachricht ein Dienstbezeichnerfeld beinhaltet; und 35
- Auslösen eines Backoff-Zeitgebers für einen bestimmten Dienst für eine bestimmte Menge an Zeit basierend auf der Backoff-Kennzeichennachricht. 40
11. Verfahren (700) nach Anspruch 10, wobei die Backoff-Kennzeichennachricht mehrere Dienstbezeichnerfelder beinhaltet, wobei das Backoff-Kennzeichen für jeden Dienst gilt, der in den mehreren Dienstbezeichnerfeldern identifiziert ist. 45
12. Verfahren (700) nach Anspruch 10, wobei die Backoff-Kennzeichennachricht mehrere Dienstbezeichnerfelder beinhaltet, wobei das Backoff-Kennzeichen für alle Dienste gilt, mit Ausnahme derjenigen, die in den mehreren Dienstbezeichnerfeldern identifiziert sind. 50
13. Einrichtung (300), die Folgendes umfasst: 55
- einen Sendeempfänger (325), der geeignet ist, um mit einem Mobilkommunikationsnetz unter Verwendung mehrerer Funkträger zu kommunizieren; und
- ein Prozessor (305), der für Folgendes geeignet ist:
- Auslösen einer ersten Vorgehensweise mit wahlfreiem Zugriff für einen ersten Funkträger, wobei der erste Funkträger mit einem ersten logischen Kanal verknüpft ist und nicht mit einer beliebigen physischen Uplink-Steuerkanalressource zum Durchführen der Ablaufsteuerungsanfragevermittlung konfiguriert ist;
- Empfangen eines Ablaufsteuerungsanfrageauslösers für einen zweiten Funkträger, während die erste Vorgehensweise mit wahlfreiem Zugriff anstehend bleibt, wobei der zweite Funkträger mit einem zweiten logischen Kanal verknüpft ist, der sich von dem ersten logischen Kanal unterscheidet, wobei der zweite Funkträger mit physischen Uplink-Steuerkanalressourcen zum Durchführen der Ablaufsteuerungsanfragevermittlung konfiguriert ist;
- Bestimmen, ob die gleichzeitige Ablaufsteuerungsanfrageübertragung für den zweiten Träger als Reaktion darauf, dass die erste Vorgehensweise mit wahlfreiem Zugriff anstehend ist, zulässig ist; und
- Übertragen einer ersten Ablaufsteuerungsanfragenachricht für den zweiten Funkträger unter Verwendung physischer Uplink-Steuerkanalressourcen, die zum Durchführen der Ablaufsteuerungsanfragevermittlung als Reaktion darauf, dass die gleichzeitige Ablaufsteuerungsanfrageübertragung für den zweiten Träger zulässig ist, konfiguriert sind.
14. Einrichtung (300) nach Anspruch 13, wobei der Prozessor geeignet ist, um durch Identifizieren einer logischen Kanalpriorität, die mit dem zweiten Funkträger verknüpft ist, zu bestimmen, ob die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, wobei die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist, wenn die logische Kanalpriorität eine Prioritätsschwelle überschreitet.
15. Einrichtung (300) nach Anspruch 13, wobei der Prozessor (305) geeignet ist, um eine Konfiguration des zweiten Funkträgers zu verwenden, um zu bestimmen, ob die gleichzeitige Ablaufsteuerungsanfrageübertragung zulässig ist.
16. Einrichtung (300) nach Anspruch 13, wobei das Mobilkommunikationsnetz die gleichzeitige Ablaufsteuerungsanfrageübertragung als zulässig definiert.
17. Einrichtung (300) nach Anspruch 13, wobei der Prozessor (305) ferner für Folgendes geeignet ist:
- Bestimmen einer ersten logischen Kanalpriorität des ersten Funkträgers und einer zweiten lo-

gischen Kanalpriorität des zweiten Funkträgers als Reaktion darauf, dass die gleichzeitige Ablaufsteuerungsanfrageübertragung nicht zulässig ist; und

Abbrechen der ersten Vorgehensweise mit wahlfreiem Zugriff als Reaktion darauf, dass die erste logische Kanalpriorität niedriger als die zweite logische Kanalpriorität ist.

18. Einrichtung (300) nach Anspruch 13, wobei der Sendempfeänger (325) geeignet ist, um eine Backoff-Kennzeichennachricht zu empfangen, wobei die Backoff-Kennzeichennachricht ein Dienstbezeichnerfeld beinhaltet, wobei der Prozessor einen Backoff-Zeitgeber für einen bestimmten Dienst für eine bestimmte Menge an Zeit basierend auf der Backoff-Kennzeichennachricht auslöst.
19. Einrichtung (300) nach Anspruch 18, wobei die Backoff-Kennzeichennachricht mehrere Dienstbezeichnerfelder beinhaltet, wobei das Backoff-Kennzeichen für jeden Dienst gilt, der in den mehreren Dienstbezeichnerfeldern identifiziert ist.

#### Revendications

1. Procédé (700) dans un équipement utilisateur, le procédé comprenant :

le lancement (705) d'une première procédure d'accès aléatoire pour un premier support radio, le premier support radio étant associé à un premier canal logique et n'étant configuré avec aucune ressource de canal de commande de liaison montante physique pour planifier la messagerie de demande ;

la réception (710) d'un déclencheur de demande de planification pour un second support radio tandis que la première procédure d'accès aléatoire reste en attente, le second support radio étant associé à un second canal logique différent du premier canal logique, le second support radio étant configuré avec des ressources de canal de commande de liaison montante pour la planification de la messagerie de demande ;

la détermination (715) de savoir si la transmission de demande de planification simultanée est autorisée pour le second support en réponse à la première procédure d'accès aléatoire en attente ; et

la transmission (720) d'un premier message de demande de planification pour le second support radio à un réseau de communication mobile à l'aide des ressources de canal de commande de liaison montante physique configurées pour planifier une messagerie de demande en réponse à une transmission de demande de planifi-

cation simultanée autorisée pour le second support.

2. Procédé (700) selon la revendication 1, la détermination (715) de savoir si la transmission de demande de planification simultanée est autorisée comprend l'identification d'une priorité de canal logique associée au second support radio.
3. Procédé (700) selon la revendication 2, comprenant en outre la comparaison de la priorité de canal logique associée au second support radio à un premier seuil de priorité, une transmission de demande de planification simultanée étant autorisée si la priorité de canal logique dépasse le premier seuil de priorité.
4. Procédé (700) selon la revendication 1, la détermination (715) de savoir si la transmission de demande de planification simultanée est autorisée étant basée sur une configuration du second support radio.
5. Procédé (700) selon la revendication 1, le réseau de communication mobile définissant une transmission de demande de planification simultanée comme étant autorisée.
6. Procédé (700) selon la revendication 1, comprenant en outre la détermination de savoir si une quantité de puissance d'émission est suffisante pour transmettre simultanément des messages pour la première procédure d'accès aléatoire et le premier message de demande de planification en parallèle, en réponse à une transmission de demande de planification simultanée autorisée, la transmission du premier message de demande de planification pour le second support radio comprenant la réduction de puissance d'un message d'une priorité inférieure du premier support radio et du second support radio.
7. Procédé (700) selon la revendication 1, comprenant en outre :
- la détermination d'une première priorité de canal logique du premier support radio et d'une seconde priorité de canal logique du second support radio en réponse à une transmission de demande de planification simultanée non autorisée ; et
- l'annulation de la première procédure d'accès aléatoire en réponse au fait que la première priorité de canal logique est inférieure à la seconde priorité de canal logique.
8. Procédé (700) selon la revendication 1, le second support radio n'étant configuré avec aucune ressource de canal de commande de liaison montante physique pour le premier message de demande de planification, la transmission du premier message

- de demande de planification comprenant le lancement d'une seconde procédure d'accès aléatoire.
- 9.** Procédé (700) selon la revendication 1, comprenant en outre :
- 5 la réception d'une autorisation de rapport d'état de mémoire tampon pour un rapport d'état de mémoire tampon en réponse au premier message de demande de planification ; et  
10 la transmission de données de liaison montante sur l'autorisation de rapport d'état de tampon.
- 10.** Procédé (700) selon la revendication 1, comprenant en outre :
- 15 la réception d'un message d'indicateur de réduction de puissance, le message d'indicateur de réduction de puissance comportant un champ d'identifiant de service ; et  
20 le lancement d'un temporisateur de réduction de puissance pour un service spécifique pendant une durée basée sur le message d'indicateur de réduction de puissance.
- 11.** Procédé (700) selon la revendication 10, le message d'indicateur de réduction de puissance comprenant une pluralité de champs d'identifiant de service, l'indicateur de réduction de puissance s'appliquant à chaque service identifié dans la pluralité de champs d'identifiant de service.
- 12.** Procédé (700) selon la revendication 10, le message d'indicateur de réduction de puissance comportant une pluralité de champs d'identifiant de service, l'indicateur de réduction de puissance s'appliquant à tous les services à l'exception de ceux identifiés dans la pluralité de champs d'identifiant de service.
- 13.** Appareil (300) comprenant :
- un émetteur-récepteur (325) adapté pour communiquer avec un réseau de communication mobile utilisant une pluralité de supports radio ; et  
un processeur (305) adapté pour :
- lancer  
une première procédure d'accès aléatoire pour un premier support radio, le premier support radio étant associé à un premier canal logique et n'étant configuré avec aucune ressource de canal de commande de liaison montante physique pour la planification de la messagerie de demande ;  
recevoir  
un déclencheur de demande de planification pour un second support radio tandis
- que la première procédure d'accès aléatoire reste en attente, le second support radio étant associé à un second canal logique différent du premier canal logique, le second support radio étant configuré avec les ressources de canal de commande de liaison montante physique pour la planification de la messagerie de demande ;  
déterminer  
le fait de savoir si la transmission de demande de planification simultanée est autorisée pour le second support en réponse à la première procédure d'accès aléatoire en attente ; et  
transmettre
- un premier message de demande de planification pour le second support radio à l'aide des ressources de canal de commande de liaison montante physique configurées pour planifier une messagerie de demande en réponse à une transmission de demande de planification simultanée autorisée pour le second support.
- 14.** Appareil (300) selon la revendication 13, le processeur étant adapté pour déterminer si la transmission de demande de planification simultanée est autorisée en identifiant une priorité de canal logique associée au second support radio, la transmission de demande de planification simultanée étant autorisée si la priorité de canal logique dépasse un seuil de priorité.
- 15.** Appareil (300) selon la revendication 13, le processeur (305) étant adapté pour utiliser une configuration du second support radio pour déterminer le fait de savoir si la transmission de demande de planification simultanée est autorisée.
- 16.** Appareil (300) selon la revendication 13, le réseau de communication mobile définissant la transmission de demande de planification simultanée comme étant autorisée.
- 17.** Appareil (300) selon la revendication 13, le processeur (305) étant en outre adapté pour :
- déterminer une première priorité de canal logique du premier support radio et une seconde priorité de canal logique du second support radio en réponse à une transmission de demande de planification simultanée non autorisée ; et  
annuler la première procédure d'accès aléatoire en réponse au fait que la première priorité de canal logique est inférieure à la seconde priorité de canal logique.
- 18.** Appareil (300) selon la revendication 13, l'émetteur-

récepteur (325) étant adapté pour recevoir un message d'indicateur de réduction de puissance, le message d'indicateur de réduction de puissance comportant un champ d'identifiant de service, le processeur lançant un temporisateur de réduction pour un service spécifique pour une durée basée sur le message d'indicateur de réduction de puissance. 5

19. Appareil (300) selon la revendication 18, le message d'indicateur de réduction de puissance comportant une pluralité de champs d'identifiant de service, l'indicateur de réduction de puissance s'appliquant à chaque service identifié dans la pluralité de champs d'identifiant de service. 10

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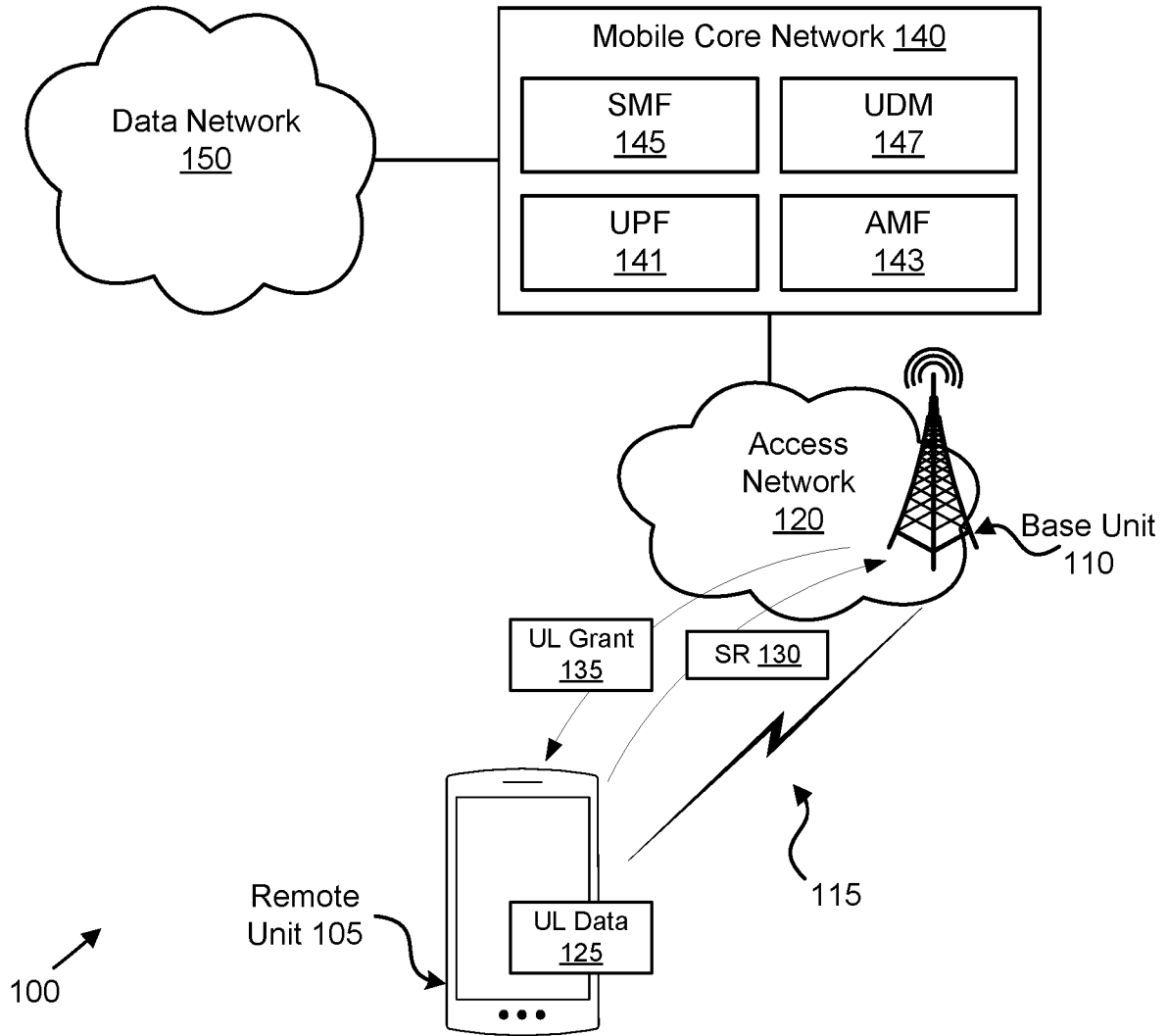


FIG. 1

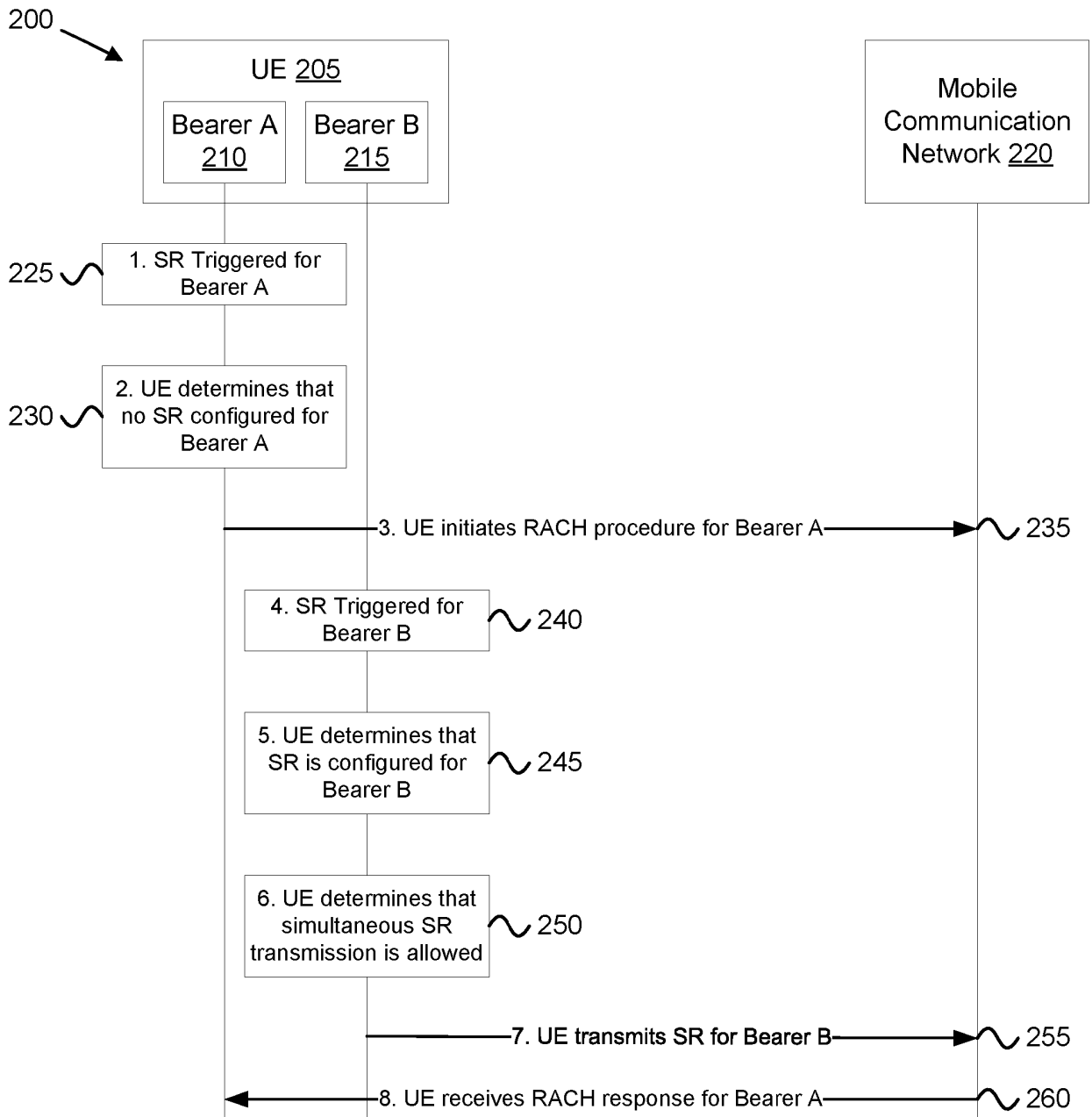


FIG. 2

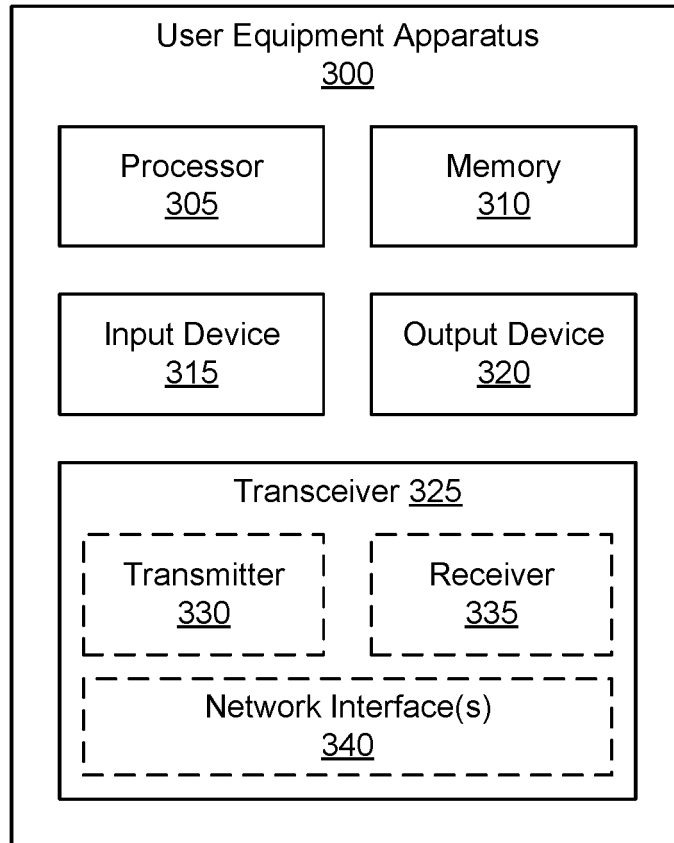


FIG. 3

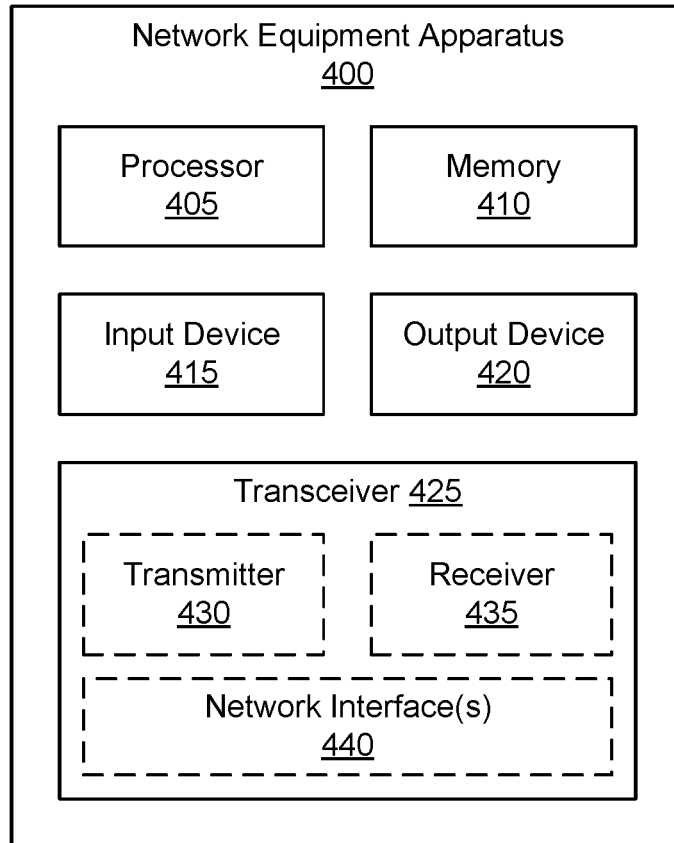


Fig. 4

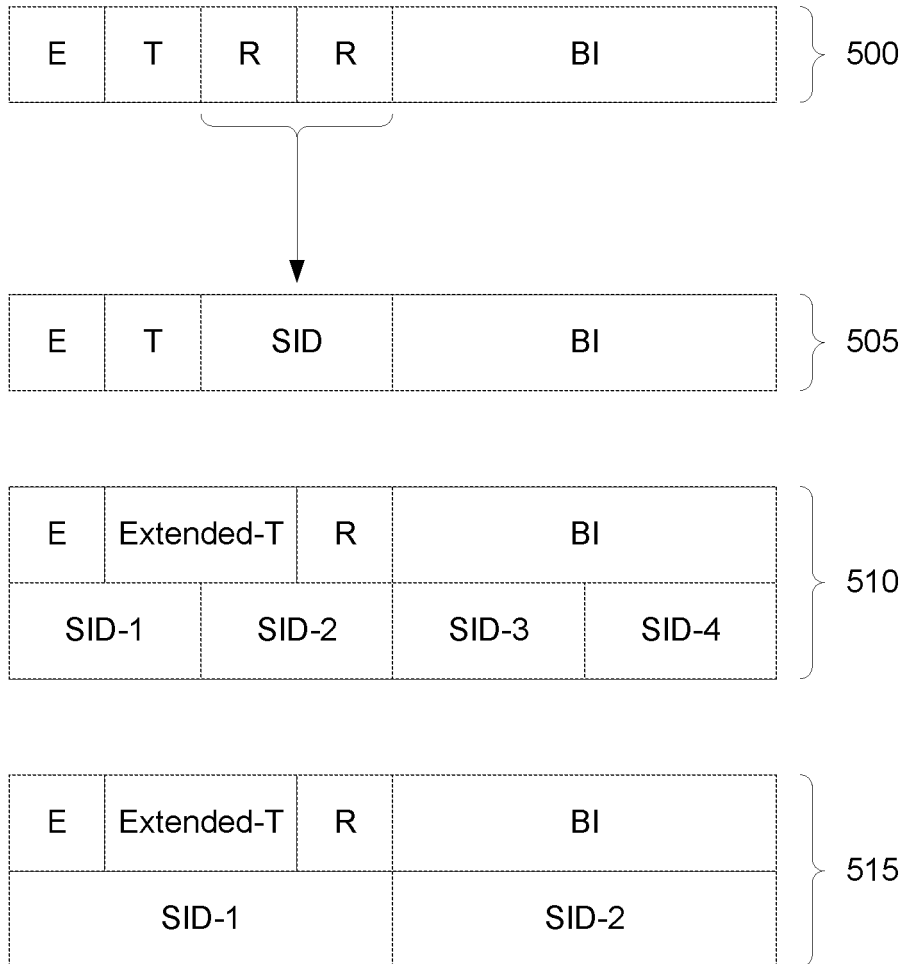


FIG. 5

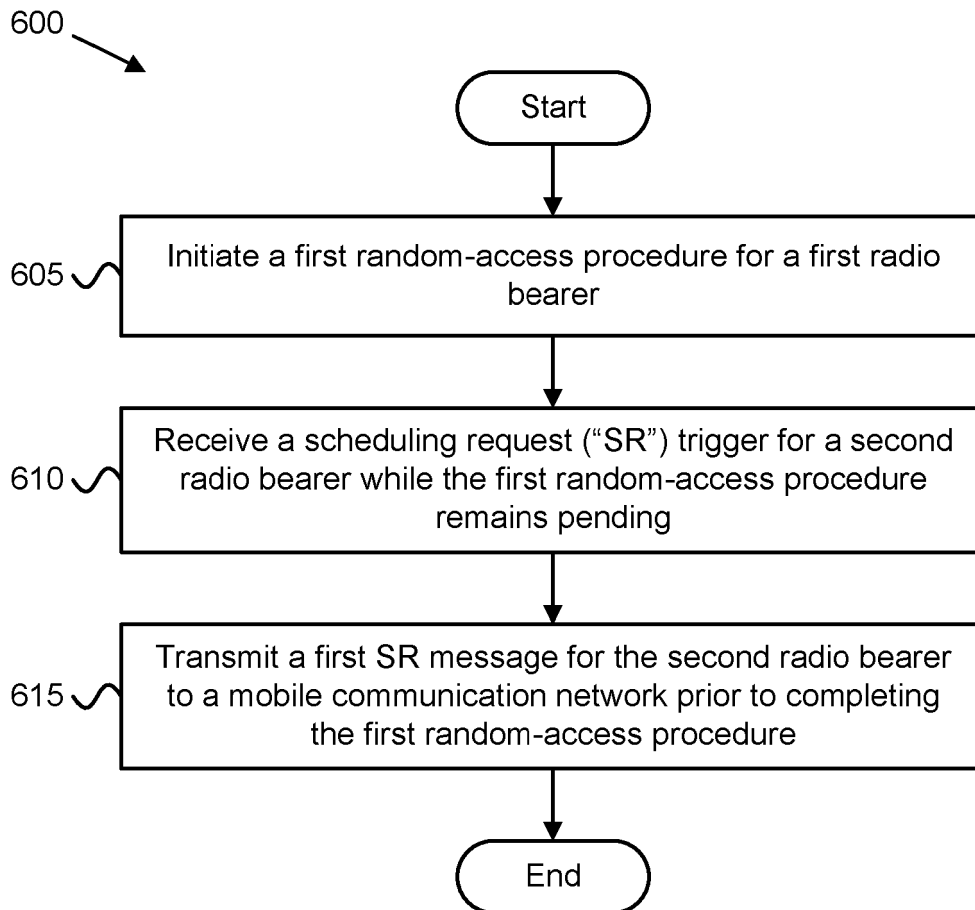


FIG. 6

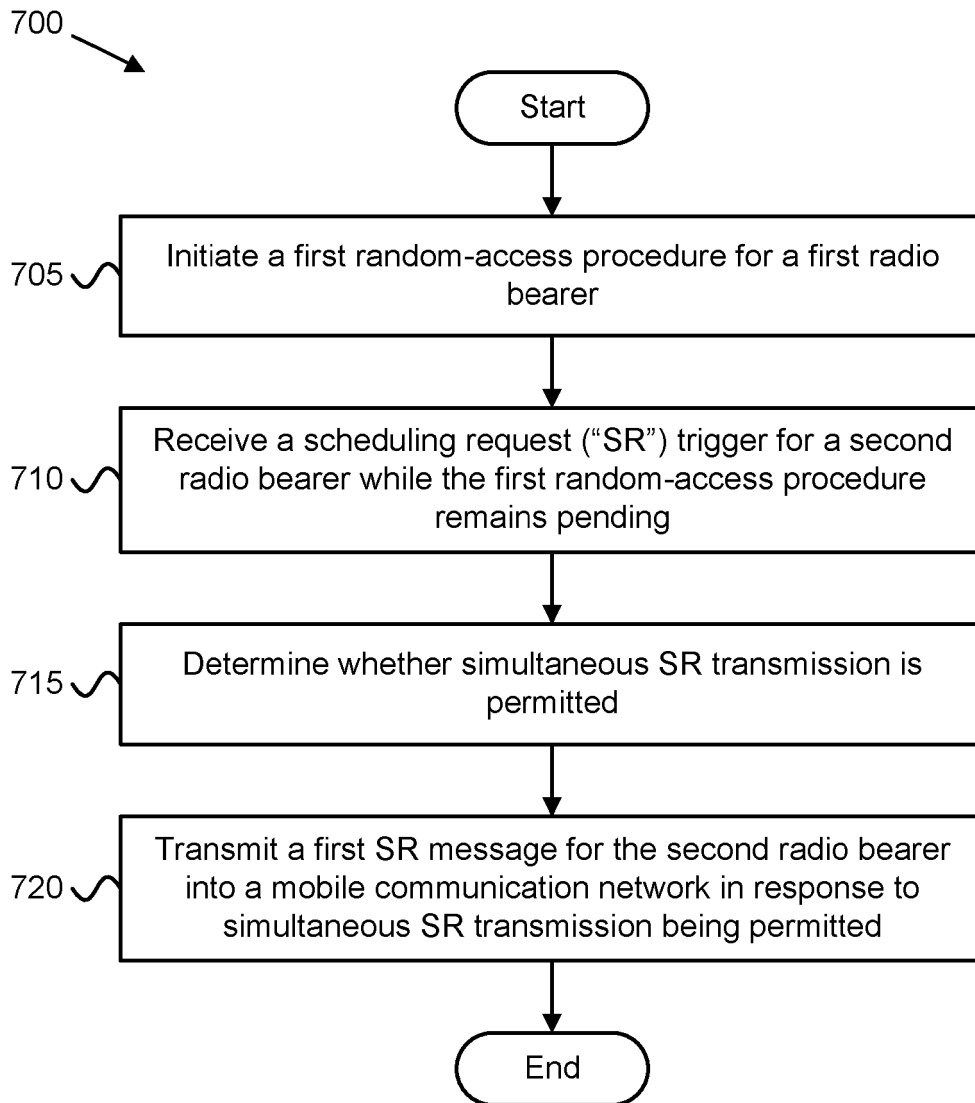


FIG. 7

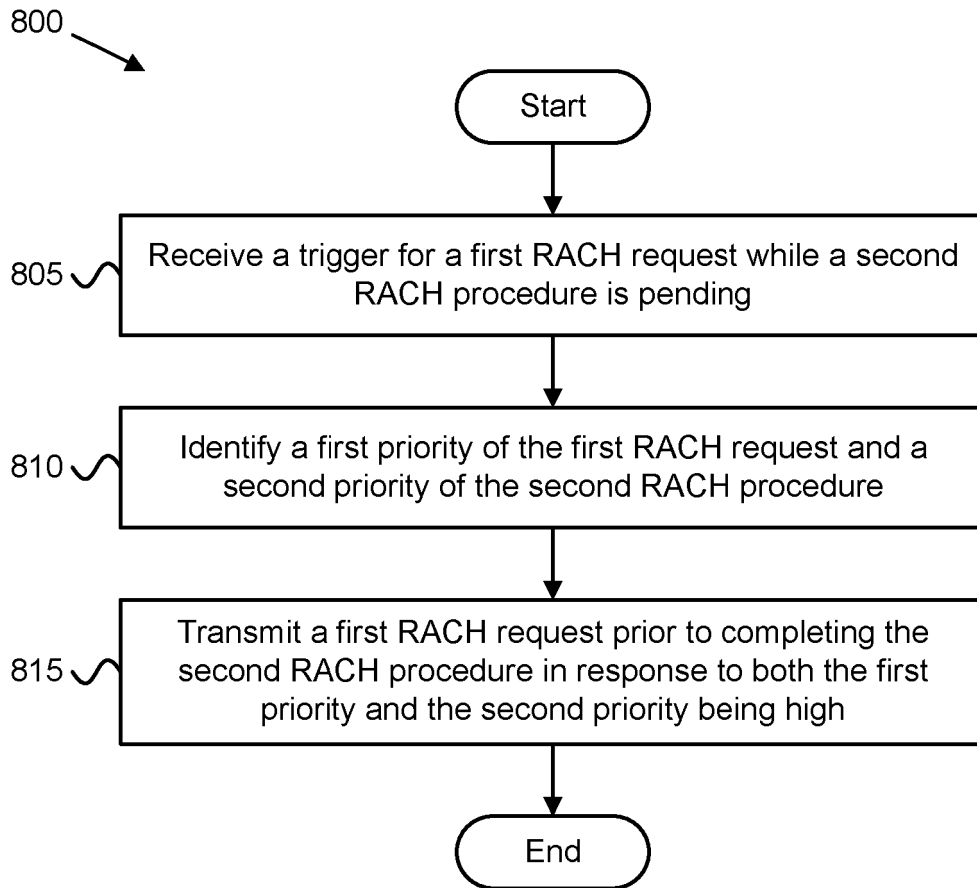


FIG. 8

**REFERENCES CITED IN THE DESCRIPTION**

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**Non-patent literature cited in the description**

- Random Access Procedure in NR. R2-1702869 is a 3GPP [0005]
- Interdigital Communications at the RAN WG2 meeting, 03 April 2017 [0005]
- Considerations on RACH procedure. R2-1702599 is a 3GPP [0005]
- **HUAWEI et al.** RAN WG2 meeting, 03 April 2017 [0005]